JETP Letters 2015 vol.101 N4, pages 240-246

Critical current of SF-NFS Josephson junctions

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Abstract

© 2015, Pleiades Publishing, Inc. The properties of SF-NFS sandwiches composed of two superconducting (S) electrodes separated by a weak-link region formed by a normal-metal (N) step with the thickness dN situated on the top of a lower S electrode and a ferromagnetic (F) layer with the thickness dF deposited onto the step and the remaining free surface of the lower electrode have been studied theoretically. It has been shown in the approximation of linearized semiclassical Usadel equations that the two-dimensional problem in the weak-link region can be reduced to two one-dimensional problems in its SFS and SNFS segments. The spatial distributions of the critical current density Jc in the segments as a function of the layer thickness dF have been calculated. The dependences of the critical current Ic of the structure on the magnitude of the magnetization vector M of the ferromagnetic layer have been found for various directions of the magnetization within the junction plane. It has been shown that these dependences are affected considerably by both the orientation of M and the spatial distribution of Jc.

http://dx.doi.org/10.1134/S002136401504013X